

THE INVENTION CLAIMED IS:

1. A method of vaporizing a processing liquid, comprising:

providing an injection valve having:

5 a vaporization region;
a processing liquid inlet coupled to the vaporization region;

a carrier gas inlet coupled to the vaporization region;

10 an outlet coupled to the vaporization region and adapted to outlet a mixture of carrier gas and vaporized processing liquid; and

15 a wave generator operatively coupled to the vaporization region so as to vibrate the vaporization region;

flowing processing liquid into the vaporization region of the injection valve; and
vibrating the vaporization region.

20 2. The method of claim 1 wherein flowing processing liquid into the vaporization region and vibrating the vaporization region occur simultaneously.

25 3. The method of claim 1 further comprising vaporizing the processing liquid within the vaporization region of the injection valve.

30 4. The method of claim 1 wherein vibrating the vaporization region comprises employing the wave generator to apply a voltage wave to a piezoelectric which controls flow of the processing liquid into the vaporization region.

5. The method of claim 1 wherein vibrating the vaporization region comprises vibrating an injection block through which the processing liquid, the carrier gas and the vaporized processing liquid and carrier gas mixture flow.

6. The method of claim 1 further comprising; dislodging residue from the vaporization region via the vibration.

7. The method of claim 6 further comprising trapping residue in a gas line coupled between the injection valve and a semiconductor wafer processing chamber.

8. A method of maintaining a semiconductor wafer processing system comprising:

performing the method of claim 6 on the injection valve when the injection valve is part of the semiconductor wafer processing system; and

thereafter, performing a cleaning process within a semiconductor wafer processing chamber operatively coupled to the injection valve.

9. A method of vaporizing a processing liquid, comprising:

flowing processing liquid into a vaporization region of an injection valve; and

simultaneously vibrating the vaporization region.

10. The method of claim 9 further comprising vaporizing the processing liquid within the vaporization region of the injection valve.

5 11. The method of claim 9 wherein vibrating the vaporization region comprises applying a voltage wave to a piezoelectric which controls flow of the processing liquid into the vaporization region.

10 12. The method of claim 9 wherein vibrating the vaporization region comprises vibrating an injection block through which the processing liquid, the carrier gas and the vaporized processing liquid and carrier gas mixture flow.

15 13. The method of claim 9 further comprising; dislodging residue from the vaporization region via the vibration.

20 14. The method of claim 13 further comprising trapping residue in a gas line coupled between the injection valve and a semiconductor wafer processing chamber.

15. A method of maintaining a semiconductor wafer processing system comprising:

25 performing the method of claim 13 on an injection valve which is part of a semiconductor wafer processing system; and

thereafter, performing a cleaning process within a semiconductor wafer processing chamber operatively
30 coupled to the injection valve.

16. A method of vaporizing a processing liquid, comprising:

providing an injection valve having:

a vaporization region;

5 a processing liquid inlet coupled to the vaporization region;

a flexible plate that defines the vaporization region and which is used to close the processing liquid inlet;

10 a piezoelectric operatively coupled to the flexible plate;

a carrier gas inlet coupled to the vaporization region;

15 an outlet coupled to the vaporization region for outletting a mixture of carrier gas and vaporized processing liquid; and

20 a wave generator operatively coupled to the piezoelectric wherein the wave generator is adjustable so as to open the processing liquid inlet, close the processing liquid inlet and vibrate the vaporization region via a voltage signal output to the piezoelectric;

flowing processing liquid into the vaporization region of the injection valve; and vibrating the vaporization region.

25 17. A method of vaporizing a processing liquid, comprising:

providing an injection valve having:

30 a plate that defines a vaporization region;

a piezoelectric coupled to the plate;

a processing liquid inlet coupled to the vaporization region;

a carrier gas inlet coupled to the vaporization region;

5 an outlet coupled to the vaporization region and adapted to output a mixture of carrier gas and vaporized processing liquid; and

a wave generator coupled to the piezoelectric wherein the wave generator is adjustable so as
10 to open the processing liquid inlet, close the processing liquid inlet and vibrate the vaporization region via a voltage signal output to the piezoelectric;

flowing processing liquid into the vaporization region of the injection valve; and
15 vibrating the vaporization region.

18. The method of claim 17 further comprising directing the wave generator to output a voltage signal of zero volts to open the processing liquid inlet.
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19. The method of claim 17 further comprising directing the wave generator to output a voltage signal having a sonic frequency to vibrate the vaporization region.

20. The method of claim 17 further comprising directing the wave generator to output a D.C. voltage signal to close the processing liquid inlet.
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21. The method of claim 20 further comprising
30 directing the wave generator to output a voltage signal having both a D.C. voltage to close the processing liquid

